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MIDbot iBuddy Education Kit

User Manual

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A. Introduction

-- “MIDbot™ iBuddy” is an educational robot kit developed by Globalactive Technology Limited. It is designed for p.4 – F.3 school students specifically, intended to promote robotics and computer programming. Compartments for this kit include IR sensors, 1 RGB LED, and 3 DC motors (2 wheels and 1 fan). “iBuddy” works with both Bluetooth wireless technology and audio control, and can also be implemented by various programming language.

-- **Compatibility**: “iBuddy” can be programmed by computer programs (Scratch, Visual Basic, Flash, C, Java, etc), smart phone apps (Android Catroid, Pocket Code) and other programming tools such as Raspberry Pi. Additional teaching and tutorial material will also be attached to this kit.

-- **Goal**: Through assembling and programming, we hope that students can study and understand robots, computer programming and the basic principles of electronics.

Functions:

1. Programmable Actions:

a. General movement

Forward, backward, left, right with speed control

b. Fan

Clockwise/anti clockwise rotation with speed control

c. RGB LED color control

1000 combinations of color LED, illustrating the principle of RGB color model

2. Line Following

“iBuddy” can track black lines on the ground with the embedded IR sensor and move around

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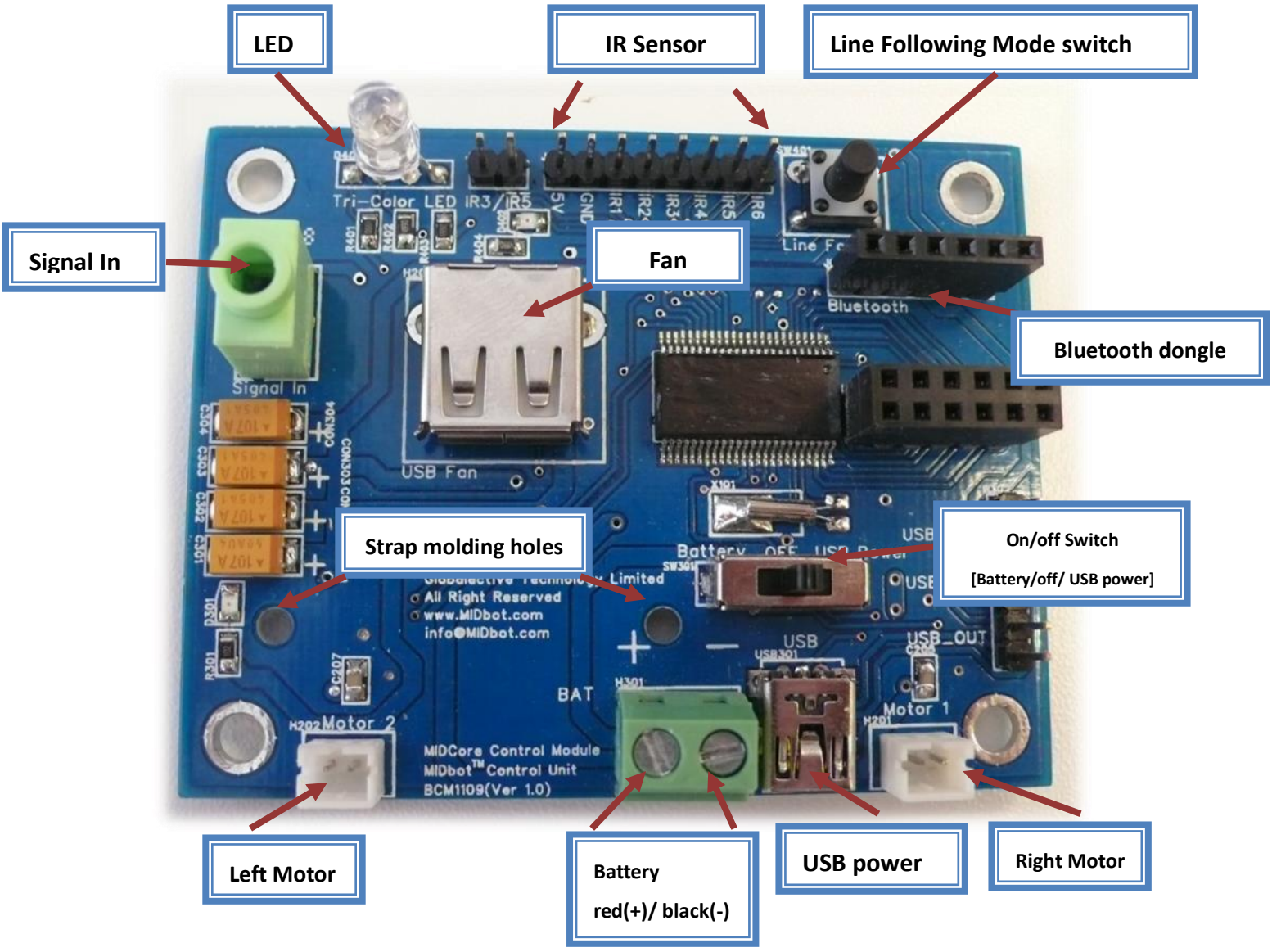
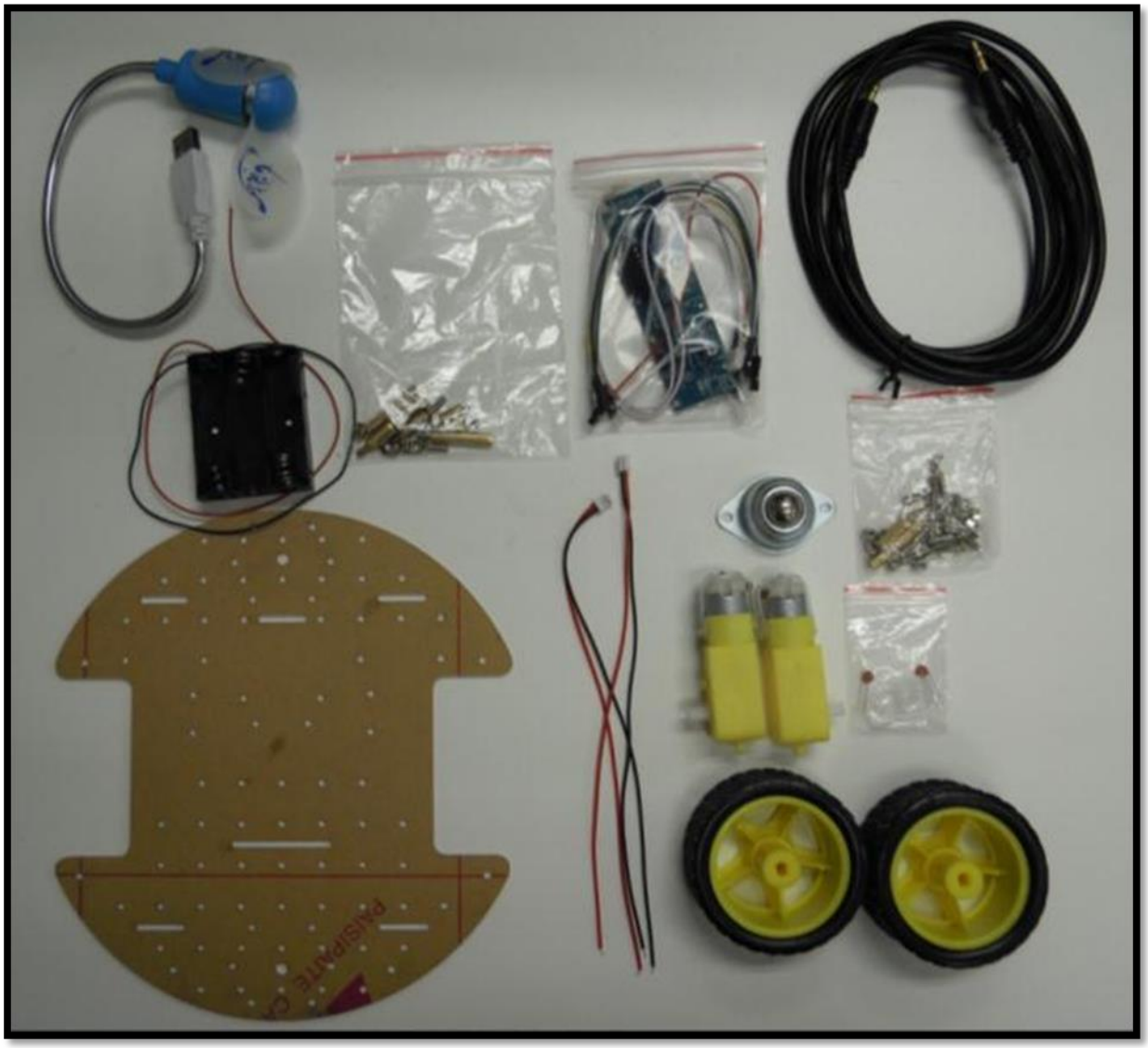
B. Module Description



C. Assembling

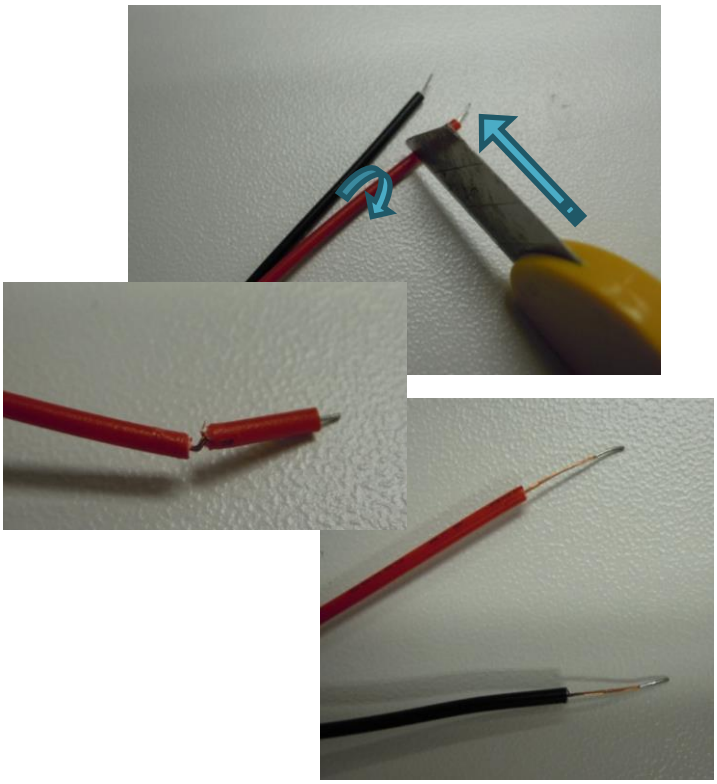
1. Parts



2. Motor installation

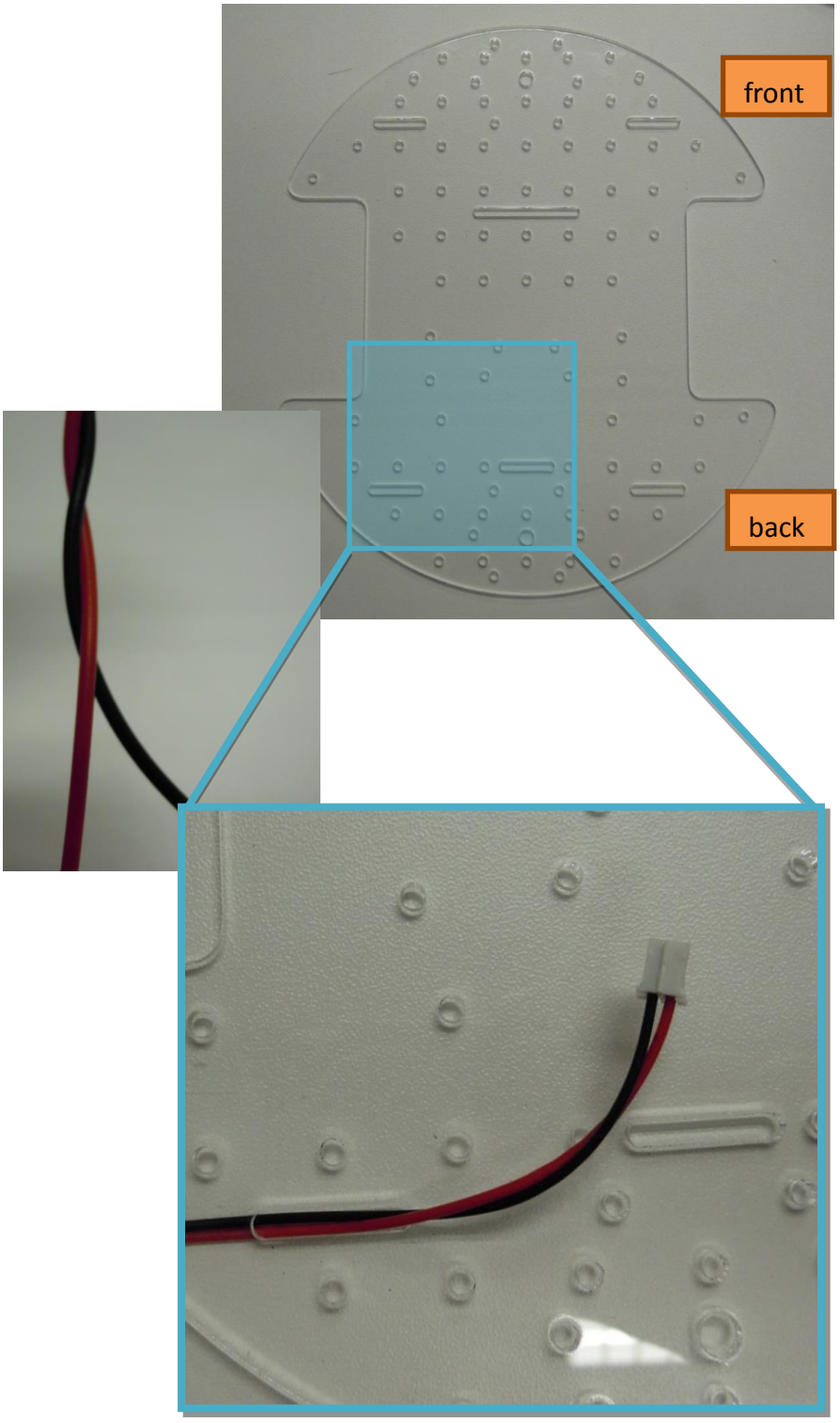
Parts needed

1. Prepare the motor wire (both red and black). Rotate the wire, while cutting the plastic coating in opposite direction. Then remove the coating.

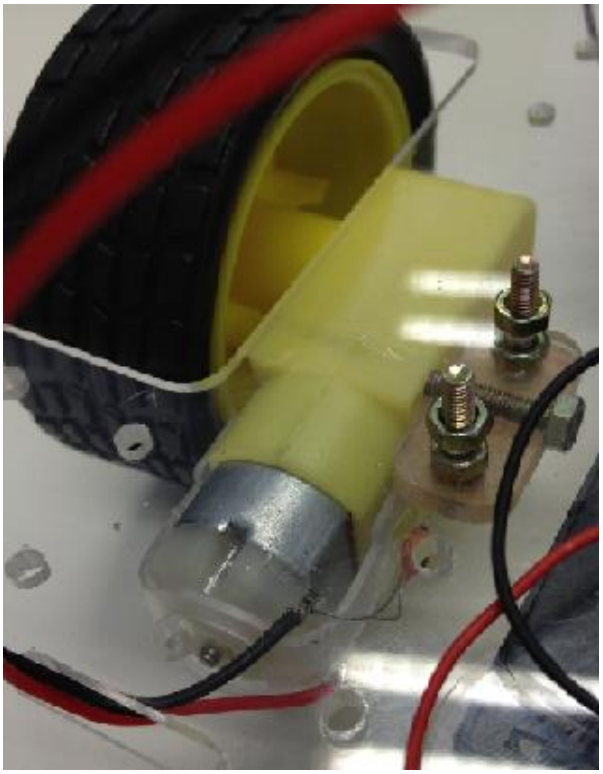


2. Twist a black and red wire together and make it pass through the rectangular hole situated at the lower left side of the transparent board.

*complete this step before connecting it to the motor

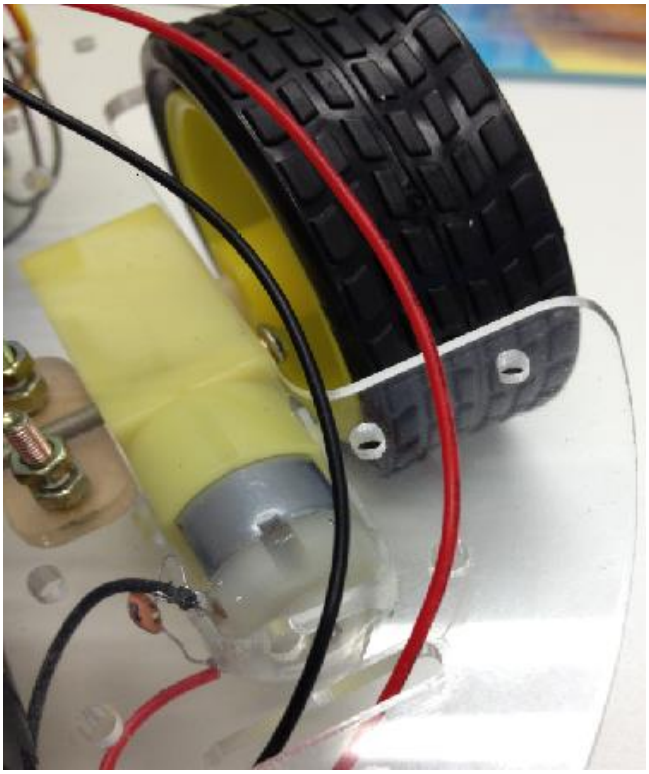


3. Confirm the direction and position of motor first.



Left motor

***black wire up, red wire down**

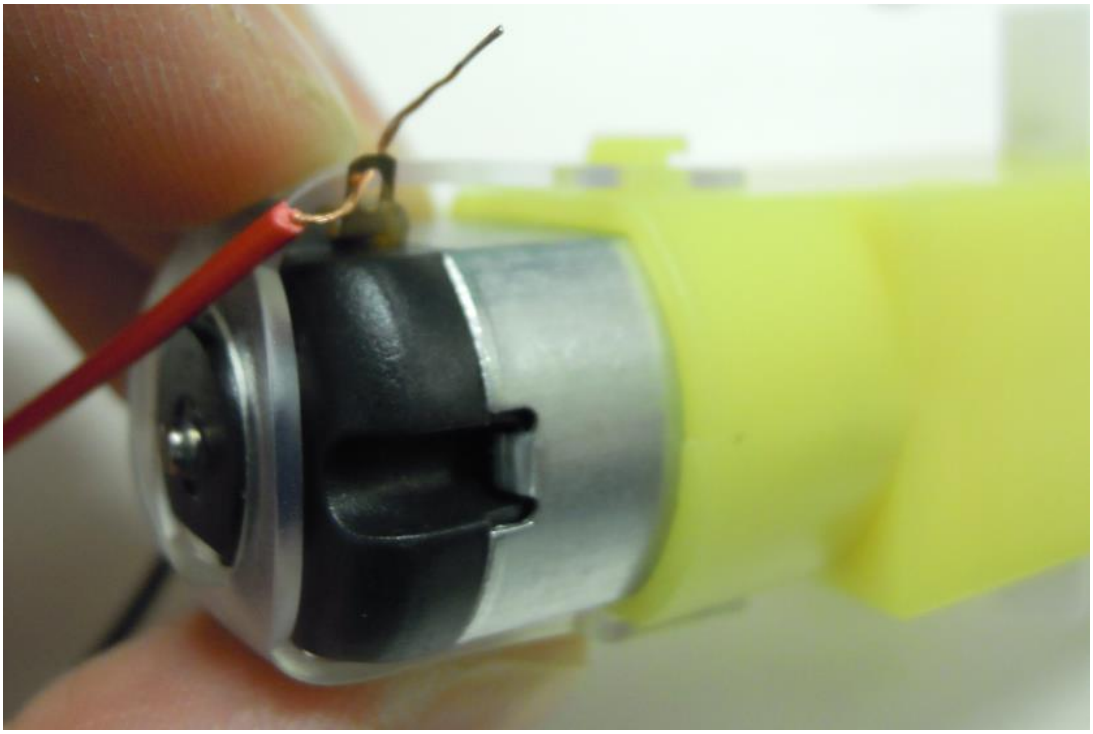


Right motor

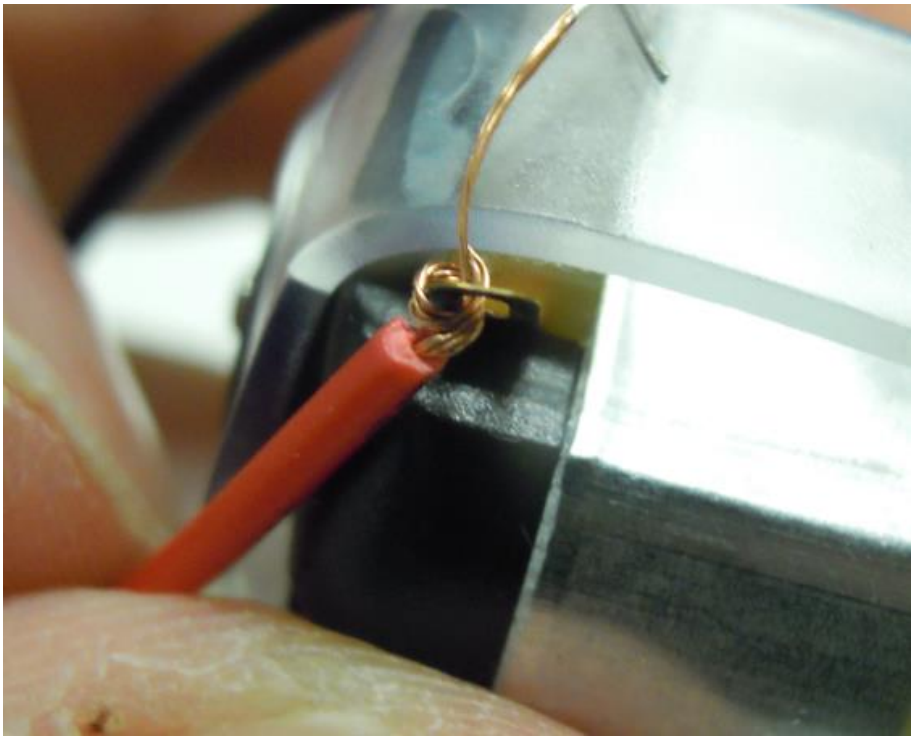
*** black wire up, red wire down**

4. fold the copper before connection **(demonstrating on left motor)**

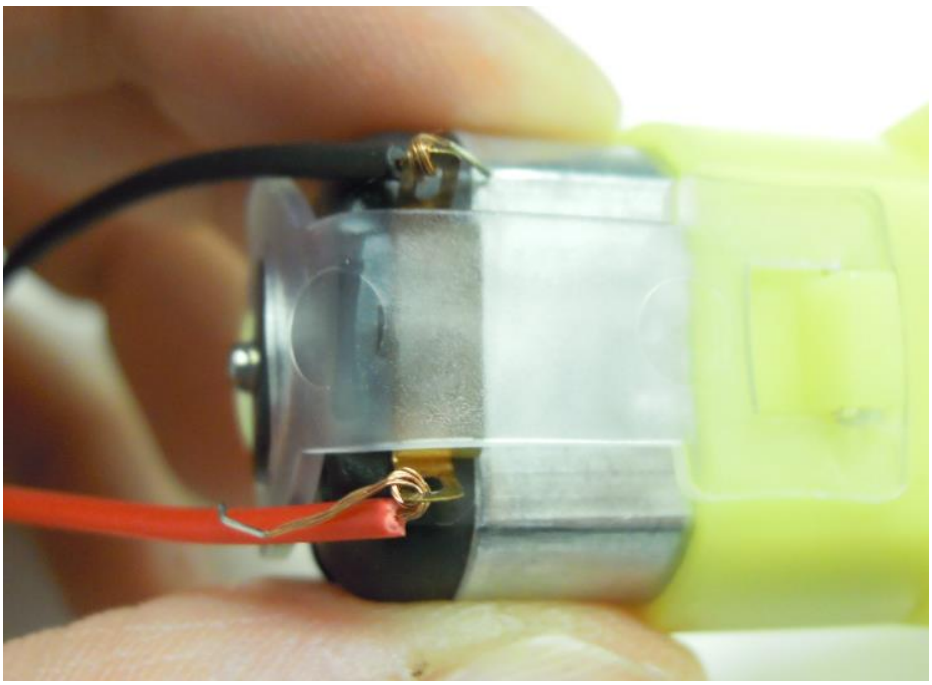
5. Twist the copper wires of the red wire and pass them through the copper strip



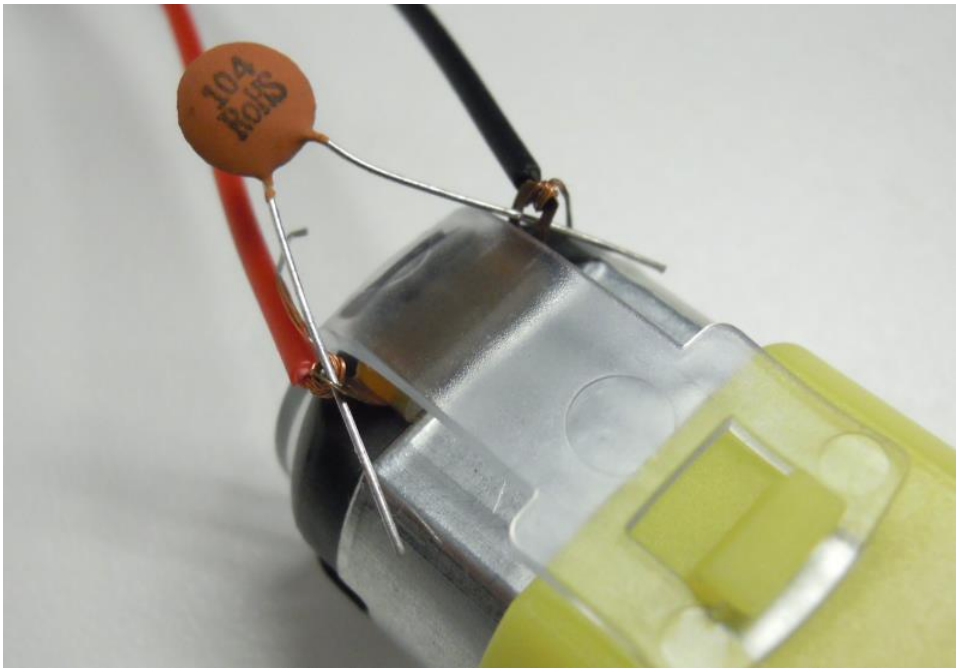
6. Wrap the wire around the copped strip



7. Repeat steps 4-6 for the black wire

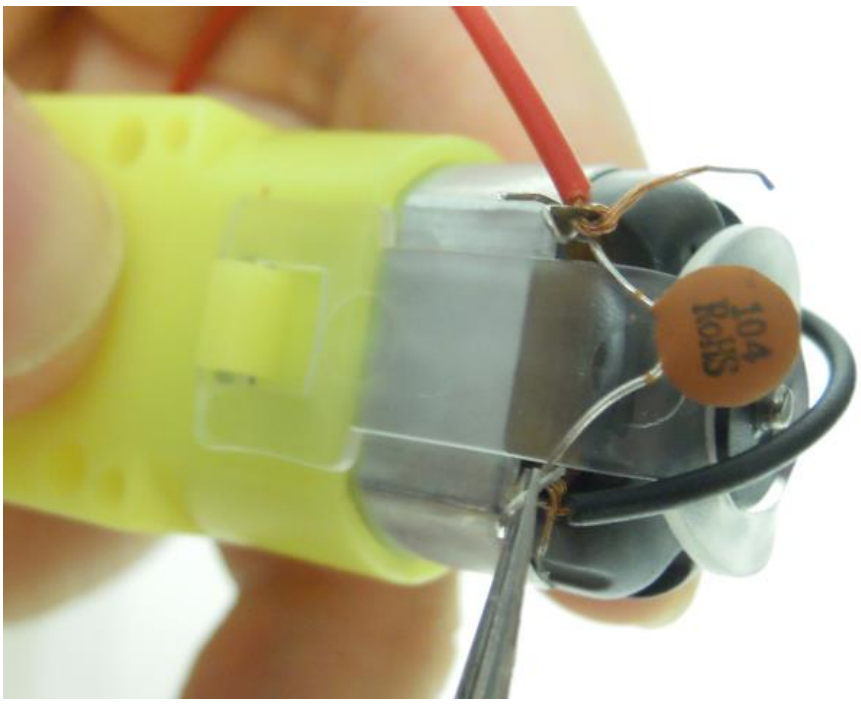


8. connect the capacitor

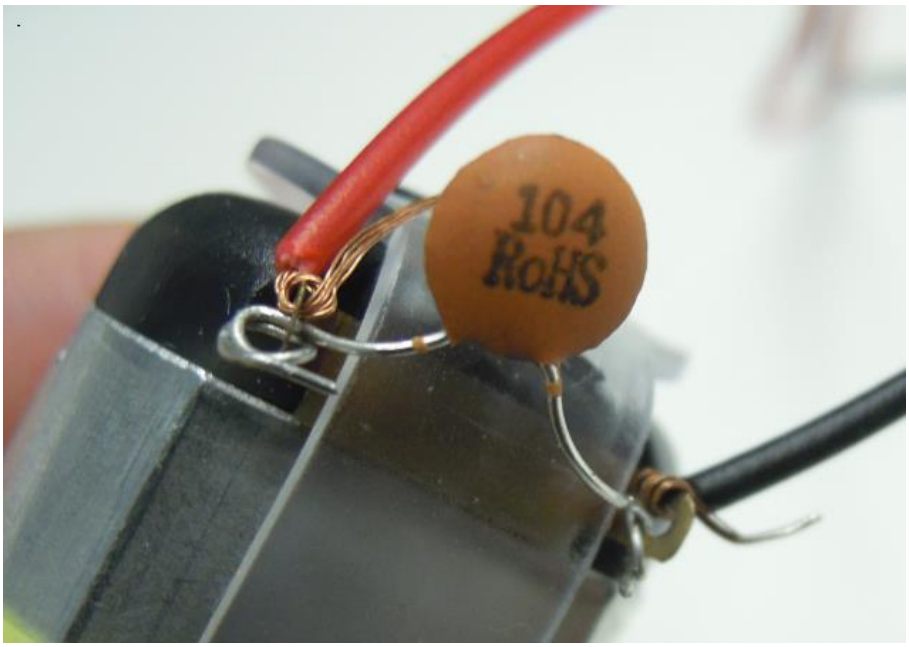


*the capacitor stabilizes motor performance but is not compulsory.

9. Tie the capacitor in and out of the copper strip



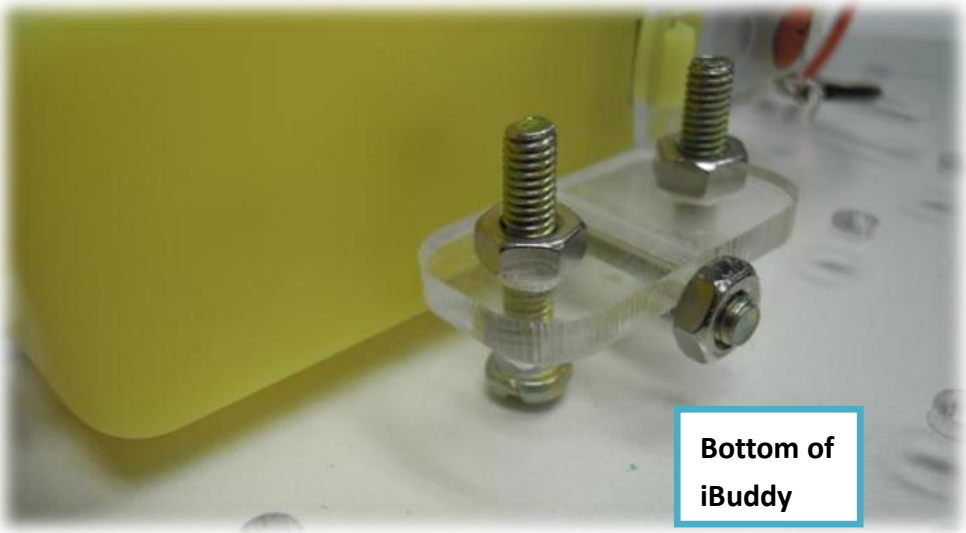
10. ***please confirm that no short circuit occurs**, You may use soldering method to strengthen the connection



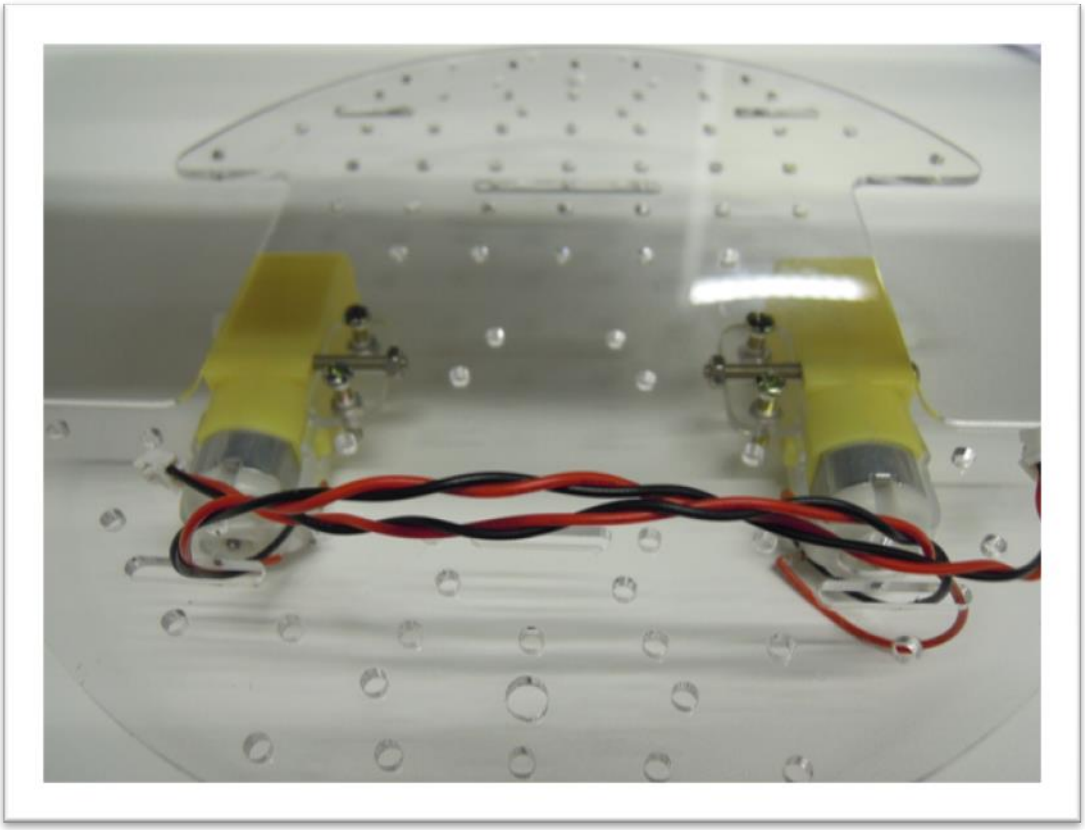
11. Repeat steps 4-10 for right motor

*** please confirm the direction and position of motor first.**

12. Adjusting the position of the motor: Plug the long screw into the motor. Clip the screw between the small plastic plate and the main plate. Fix them with screws and boltss.

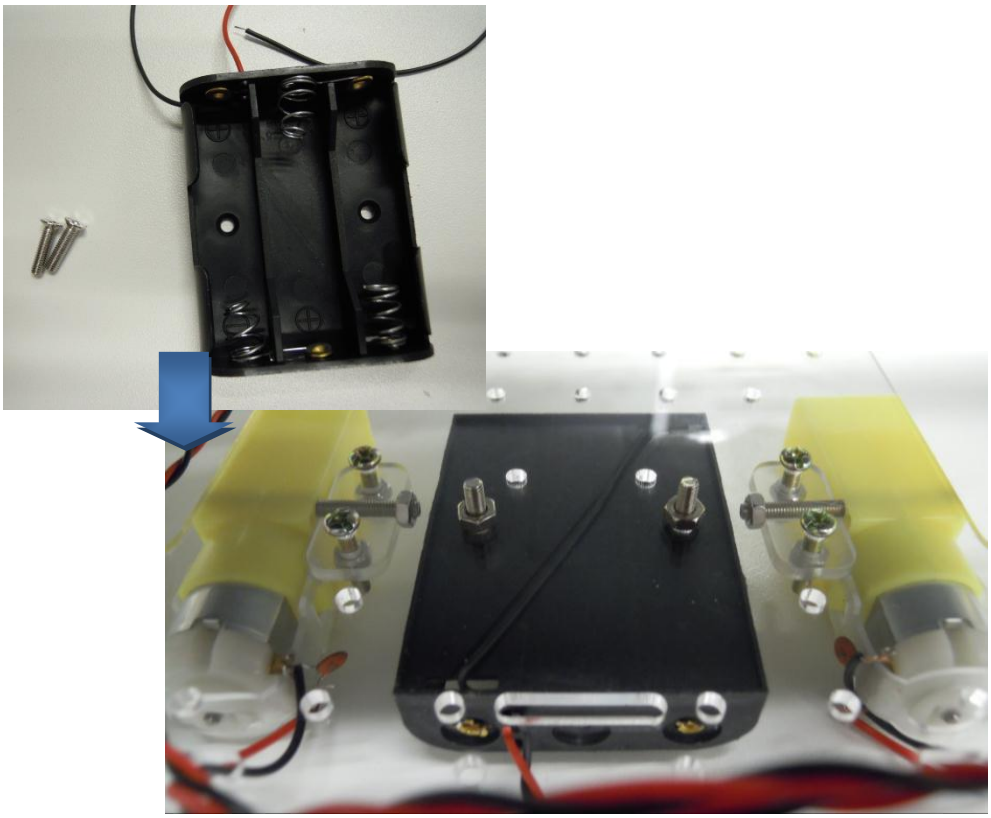


13. After motor installation



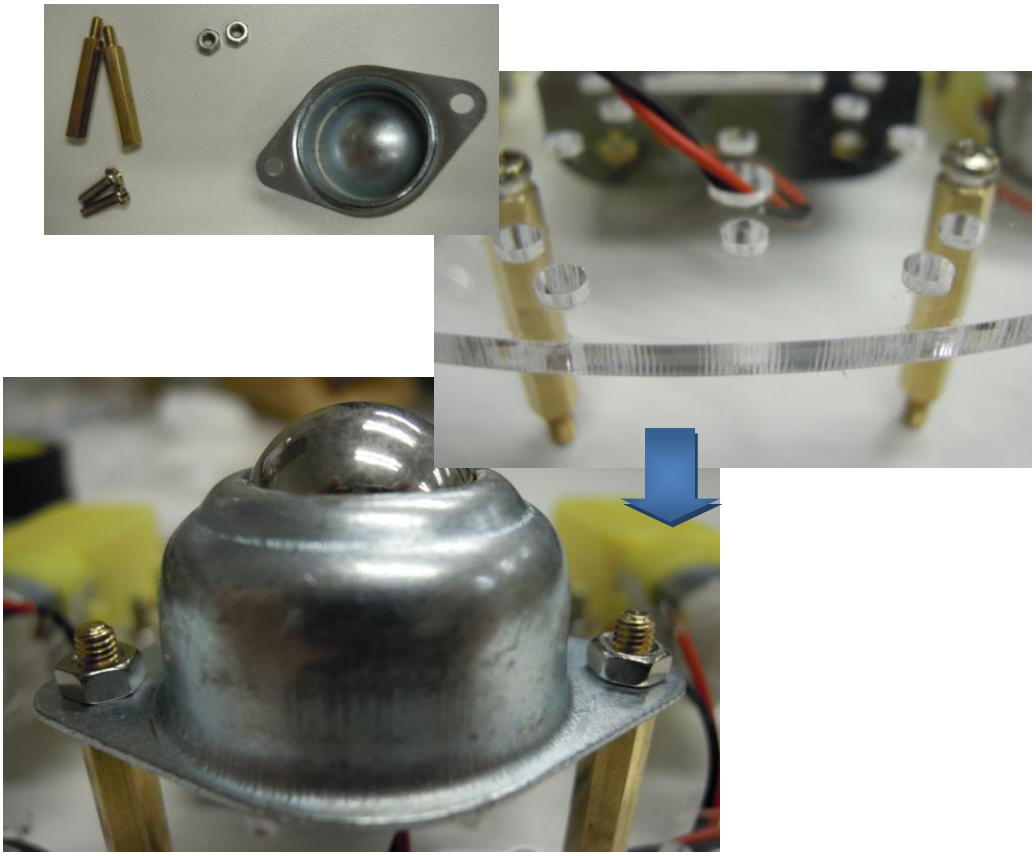
3. Battery box installation

Use screws and bolts to secure the battery box. Battery box and motors should be on the same side of the plastic board.

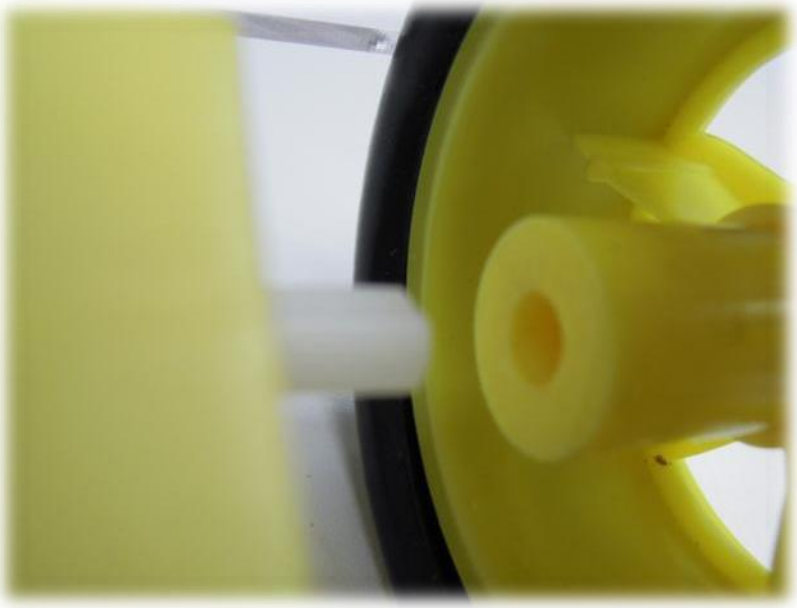


4. Wheel installation

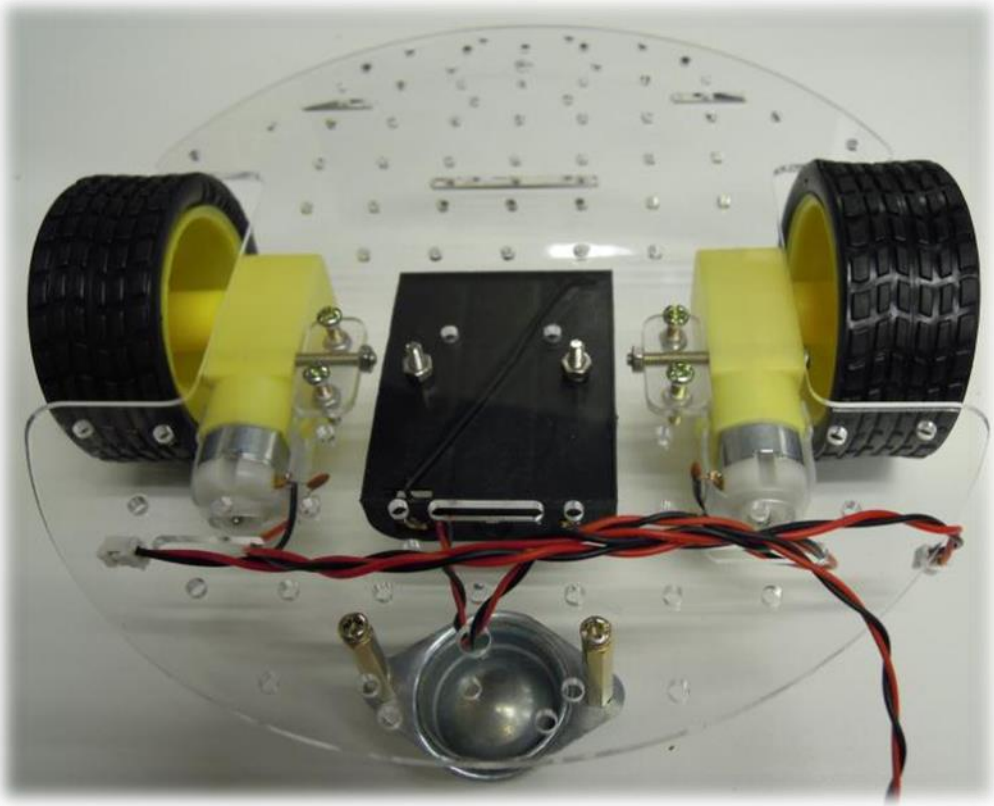
1. To install the ball wheel, first, secure the bolts on the plastic plate with screws, and then fix the wheel on the bolts with nuts.



2. To install the wheels, plug them to the motor.

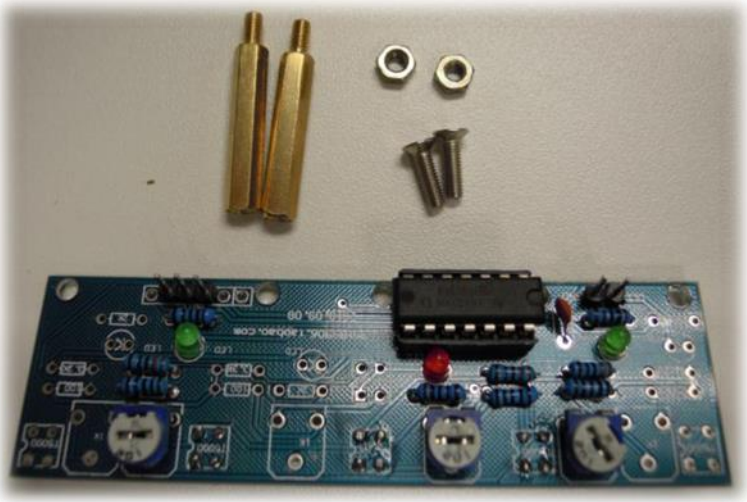


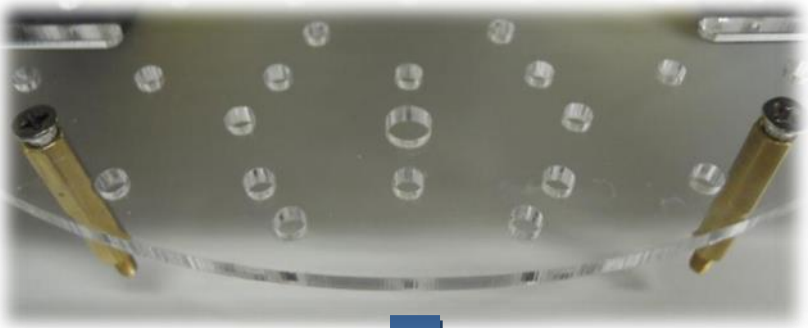
3. After-wheel-installation look



5. IR board installation

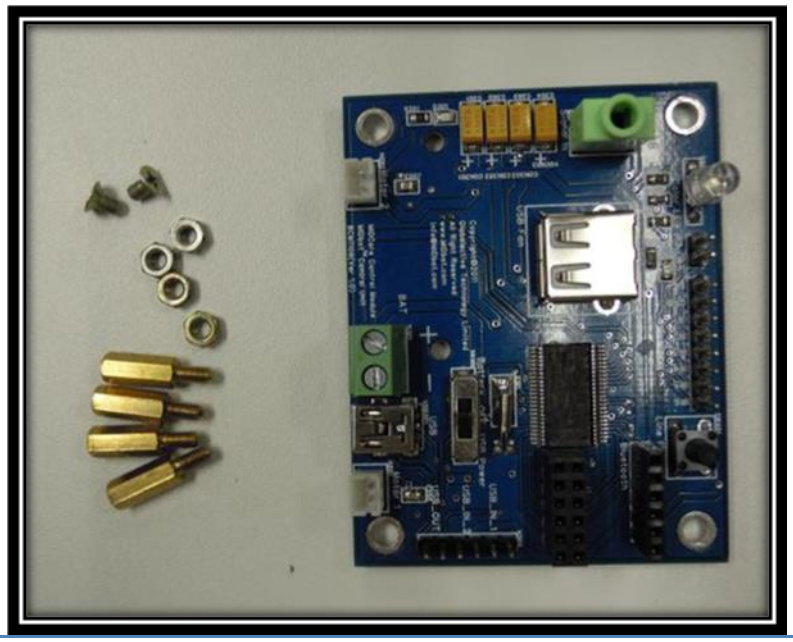
First fix the bolts on the plastic plate with screws, then fix the IR board onto the bolts with nuts



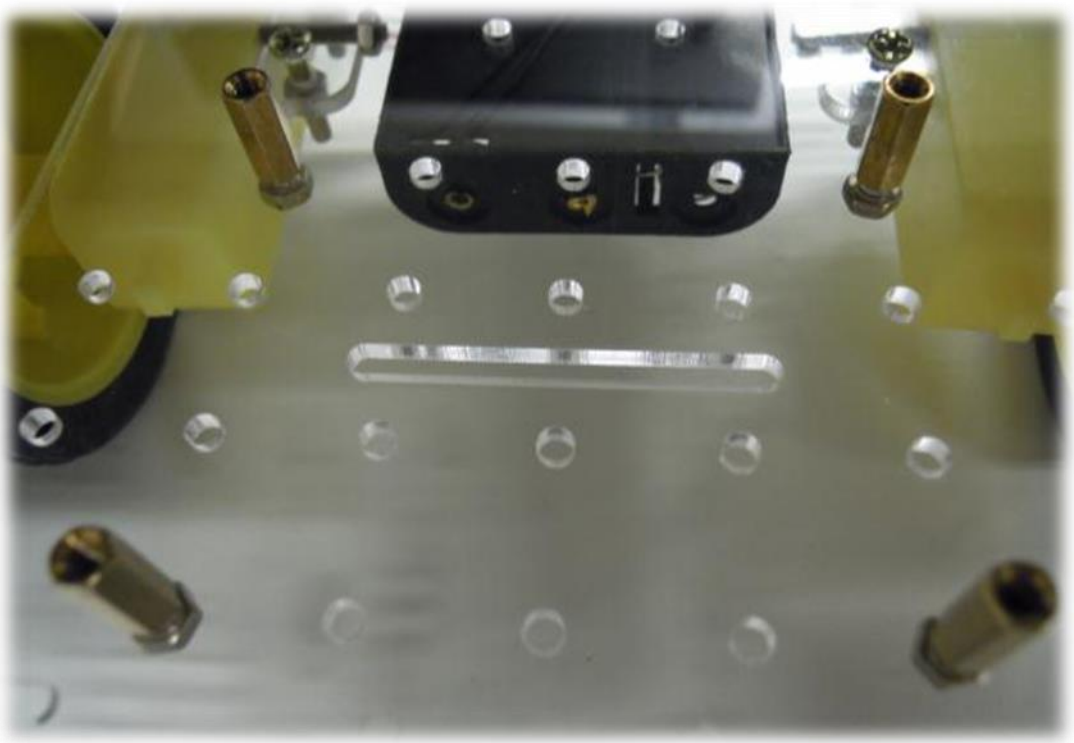


6. Main board installation

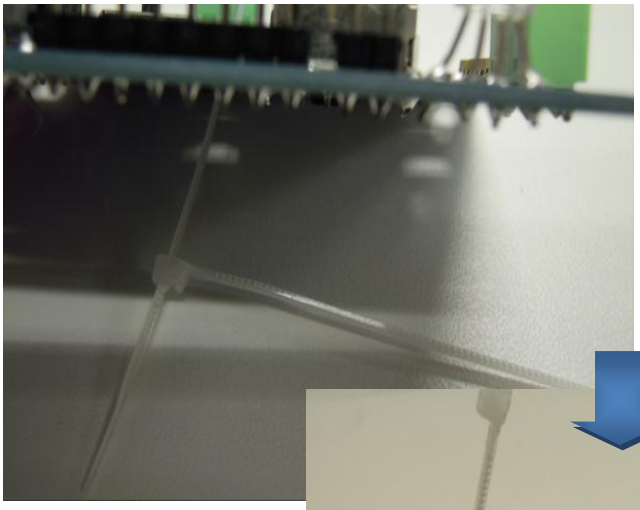
1. Parts needed

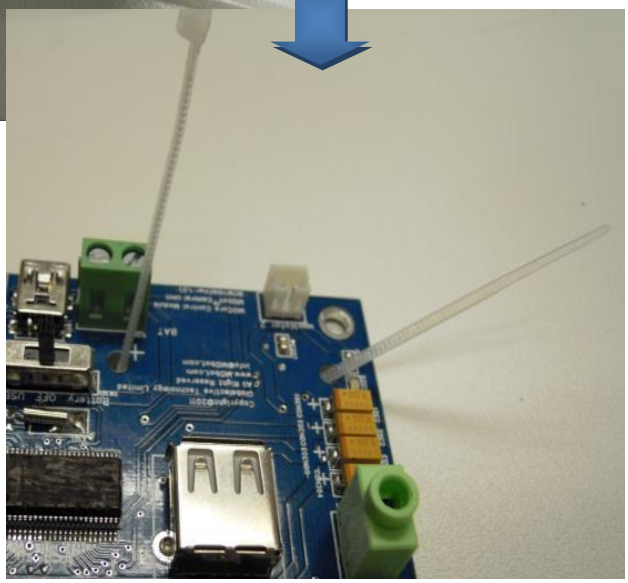


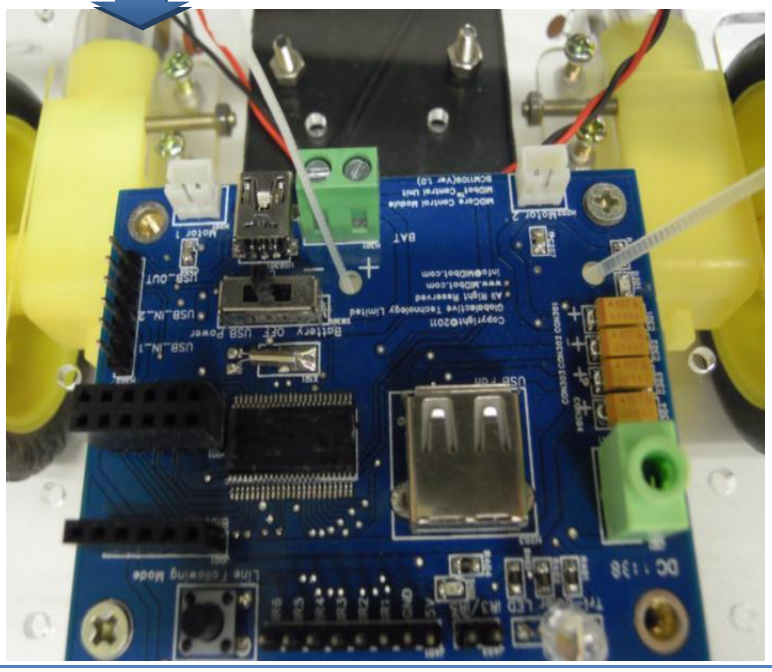
2. fix the bolts onto the plastic plate with nuts



3. Prepare the plastic strap to fasten the fan. Fix the main board with two diagonal screws.

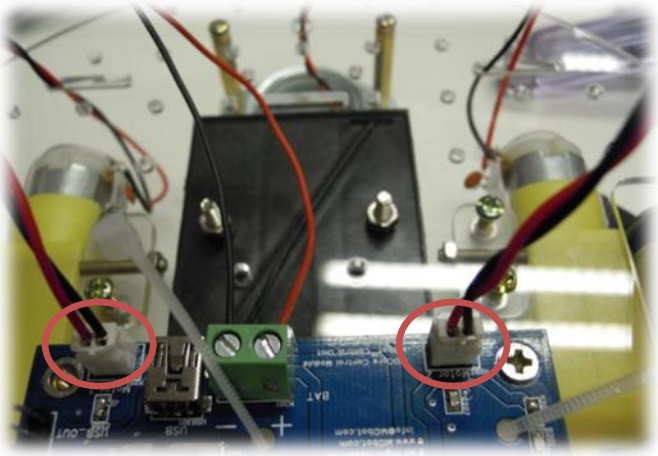




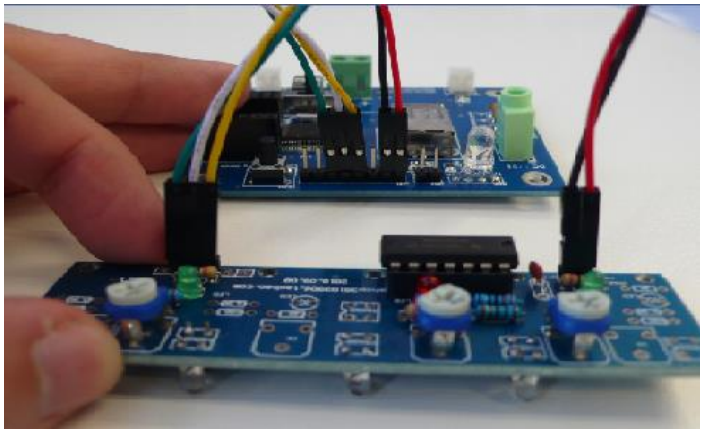


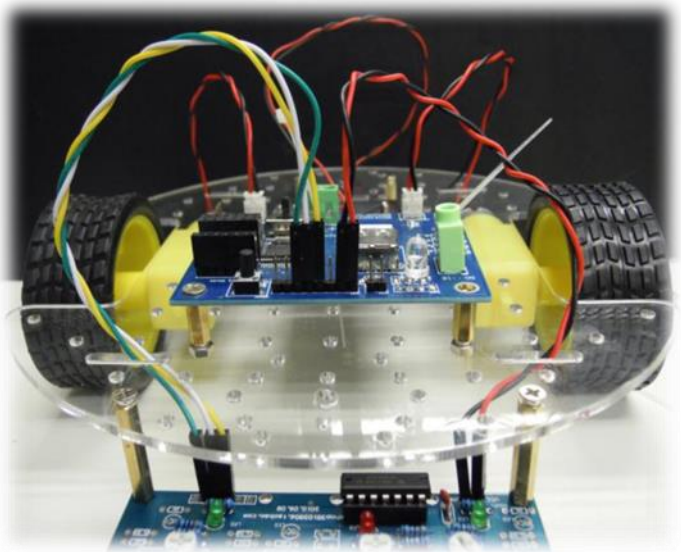
7. Circuit connection

1. Motor: plug in the motor wire



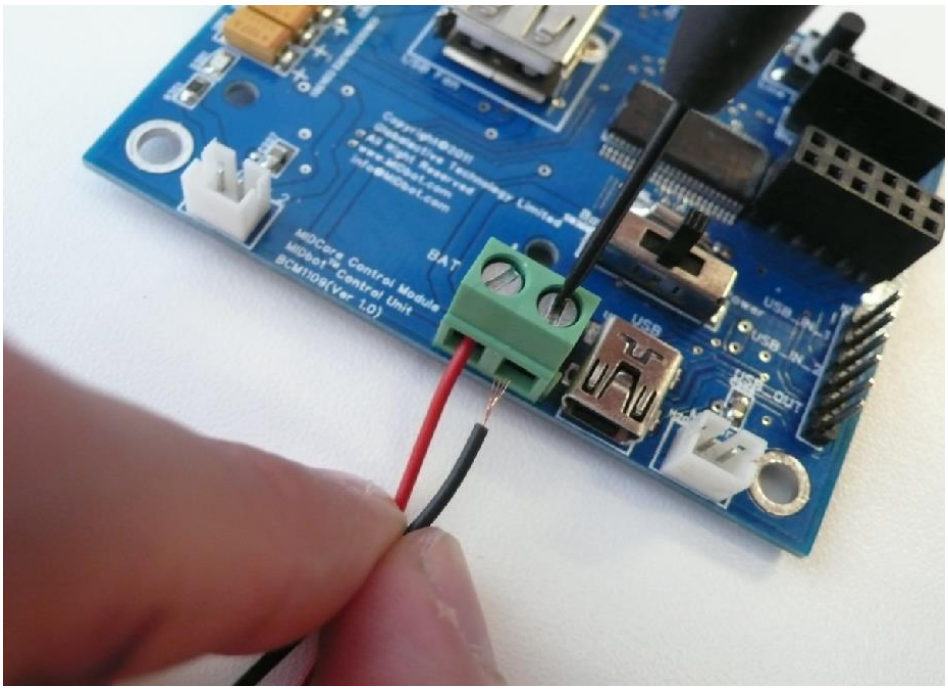
2. IR board: connect according to diagram



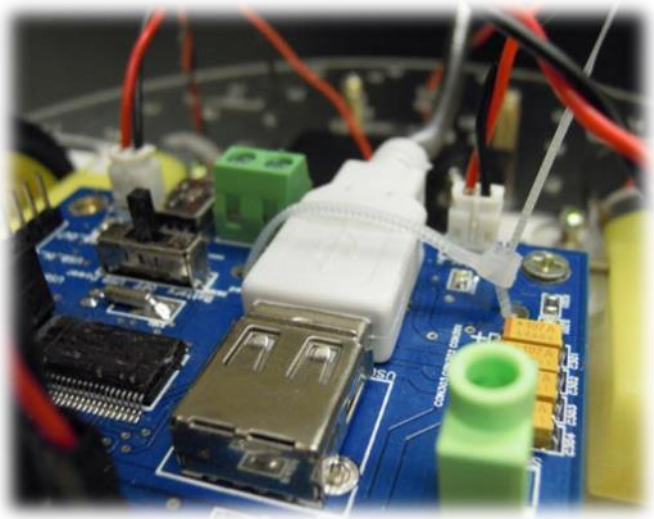


3. Power: insert the wire from battery box into main board with screwdriver.

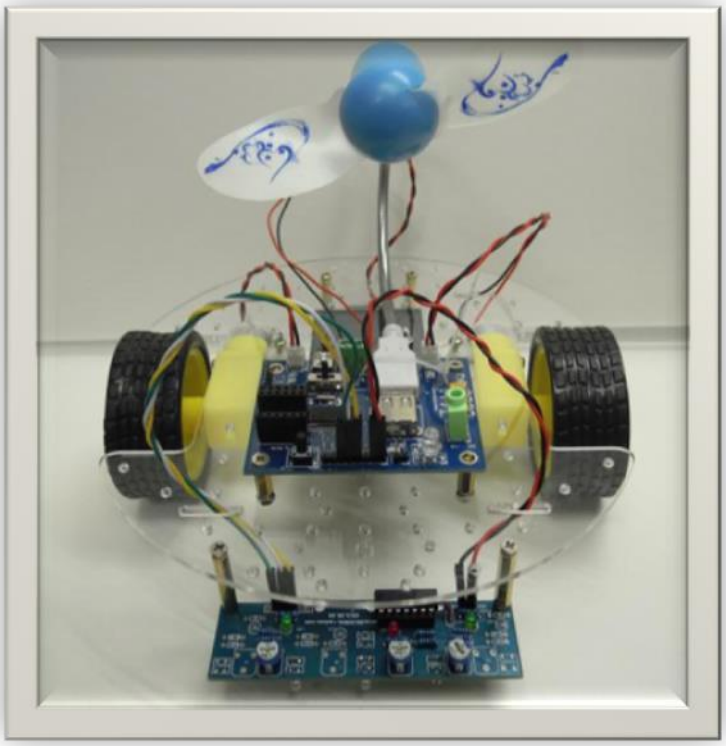
***red wire(+VE), black wire (-VE)**

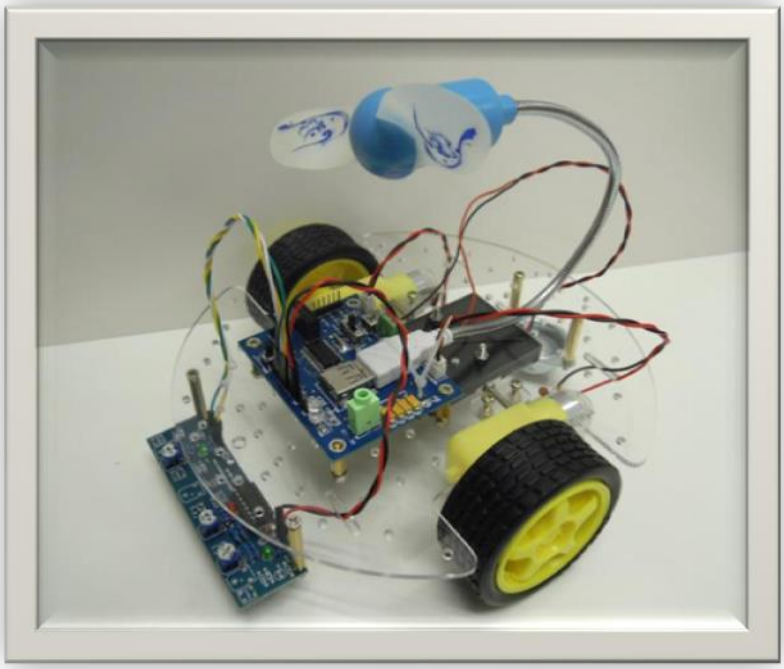


4. Fan: plug in the fan and fasten with plastic strap.



8. Final product





D. Component list & accessories

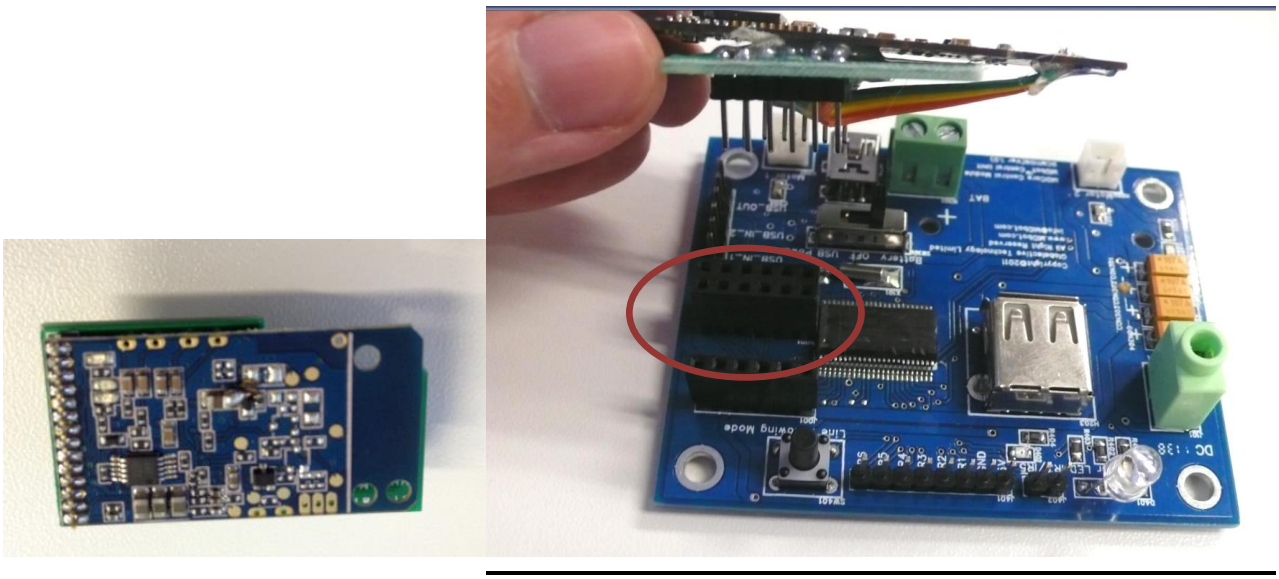
Component	pcs
Main Board	1
DC motor	2
IR board (3 floor sensors)	1
USB fan	1
Wheel	2
ball wheel	1
Battery box	1
Signal cable (3m)	1

Accessories	Function
Bluetooth module	Wireless control is possible when Bluetooth module is installed Command is sent through Bluetooth. Connection stability is enhanced and using one-to-one pairing which is not easily jammed or interfered. The control distance can be up to 10 meters.
IR board (5 floor sensors) with front sensor (programming not supported)	Switching to IR board (5 floor sensors) boost the black - line - tracking ability. The front sensor can avoid colliding with obstacles.
Signal cable (3m)	For signal transmitting, replacing the damaged one if necessary.

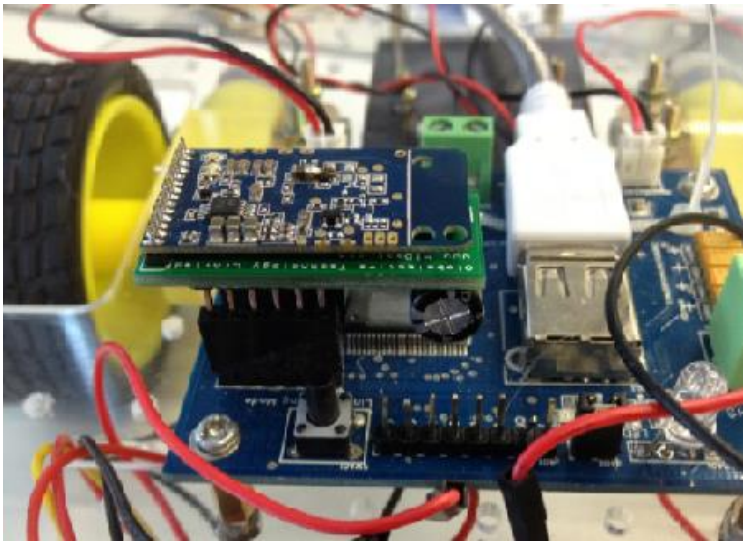
E. Bluetooth & IR Connection

1. Bluetooth Installation

1, Install the Bluetooth module to the main board



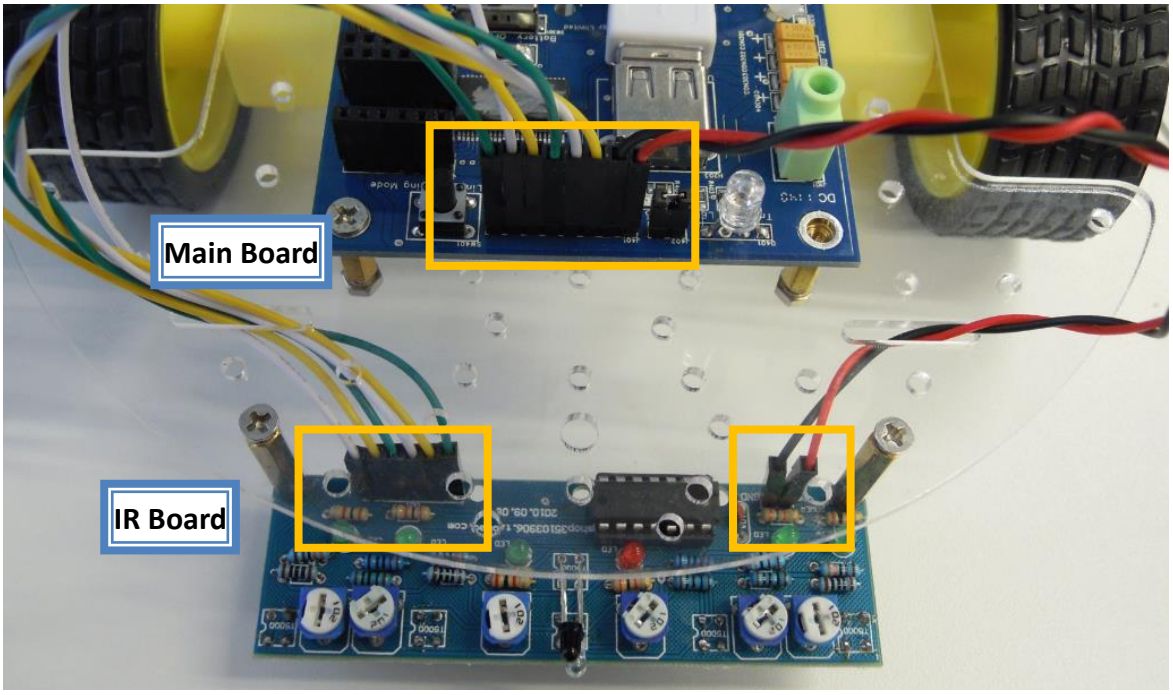
2, Press in the Bluetooth module to ensure it is connected properly.



*for Bluetooth pairing, please refer to other document

2. IR Connection

1. Assign the Main Board wires numbers 1-8 from left to right. Correspond and connect the respective wires using the numbers given at the bottom of this picture. [EXAMPLE: the 1st white wire from the left is number 2. As the first spot for the IR board is 2, you should plug in the other end of the same white wire into the first slot.]



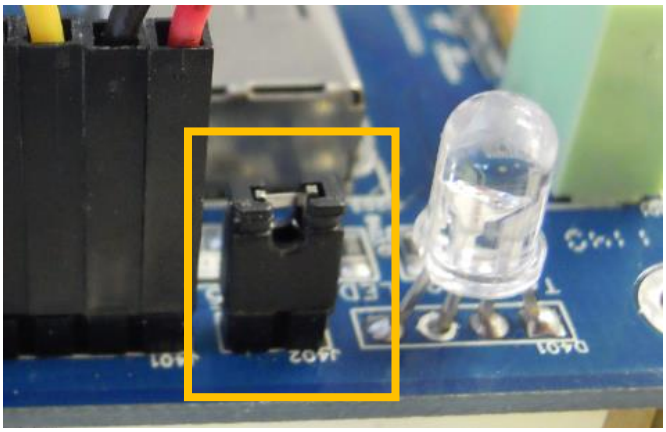
Main Board

1	2	3	4	5	6	7	8

IR Board

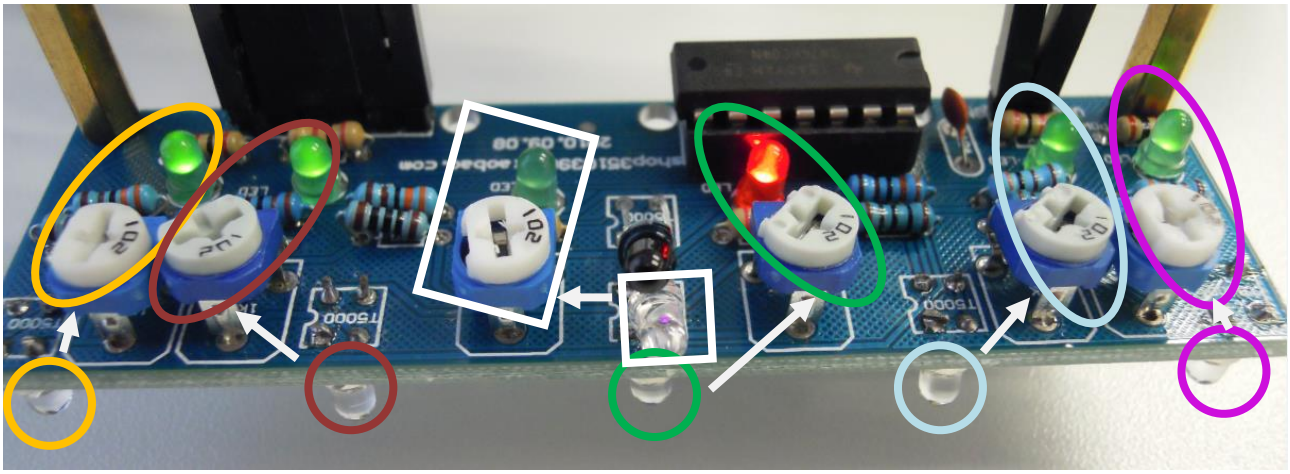
2	3	4	5	6	1	7	8

2. Install jumper [*remove when using IR broad with 3 floor sensors only]



F. Tune IR Sensitivity

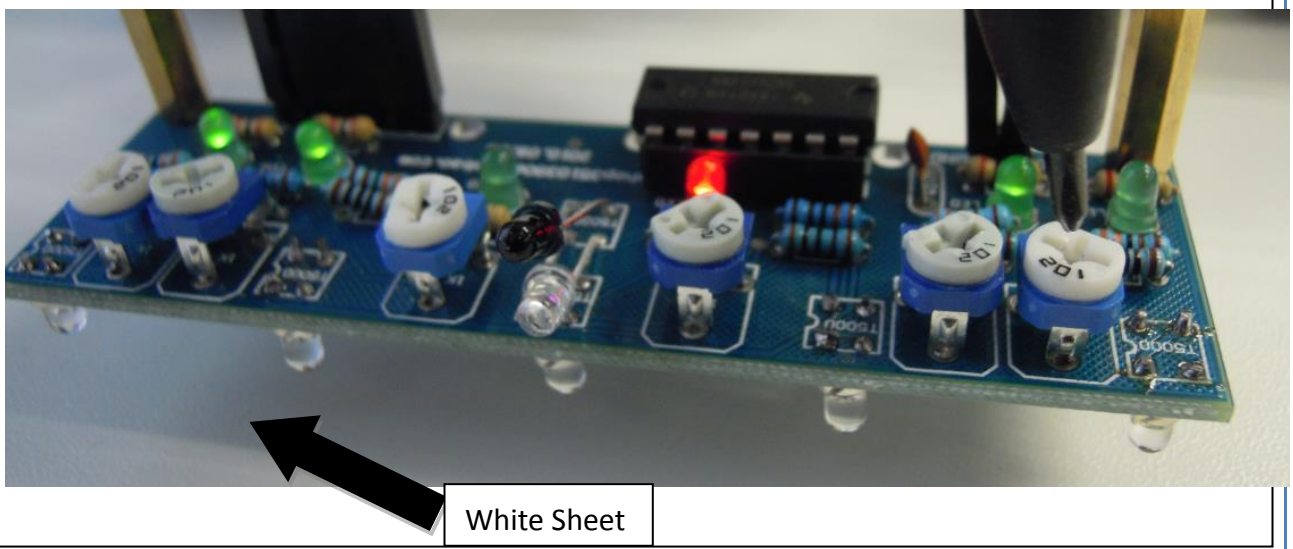
1. IR Sensor and related variable resistor (VR)



Circled are floor sensors and ellipses are variable resistors for tuning.

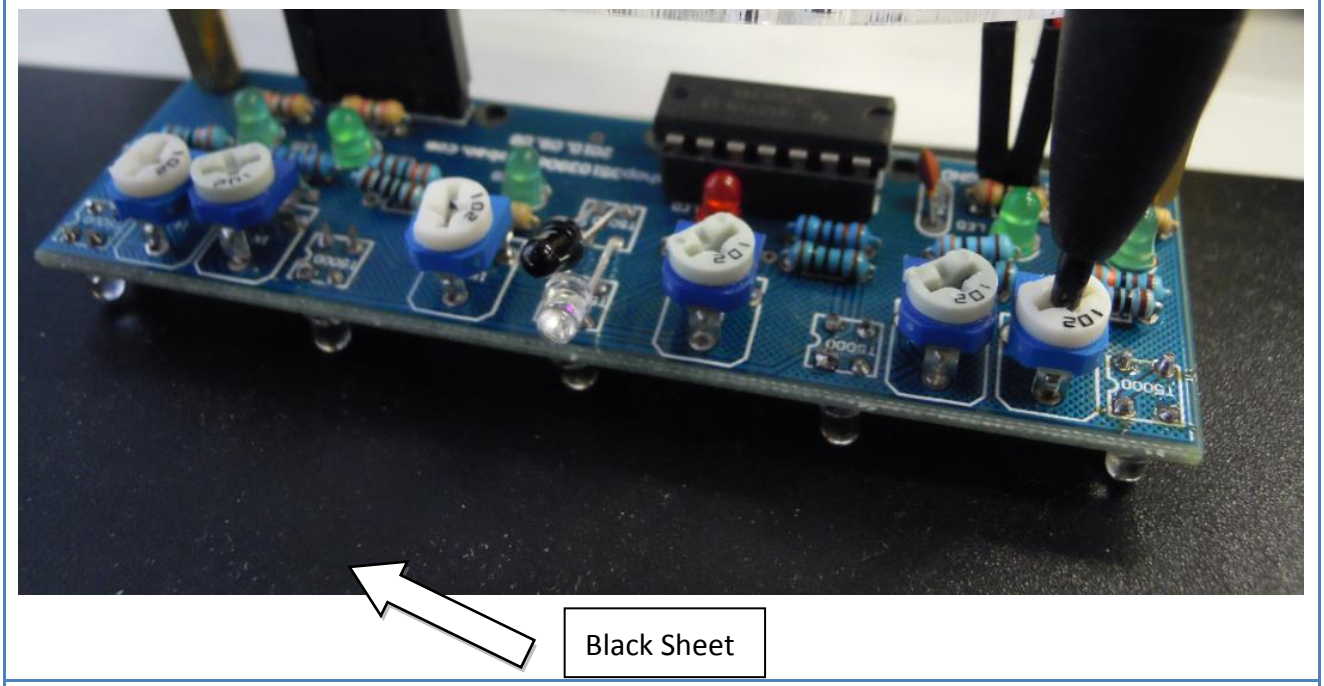
Square is front sensor and rectangle is variable resistor for tuning.

2. Tuning Sensors

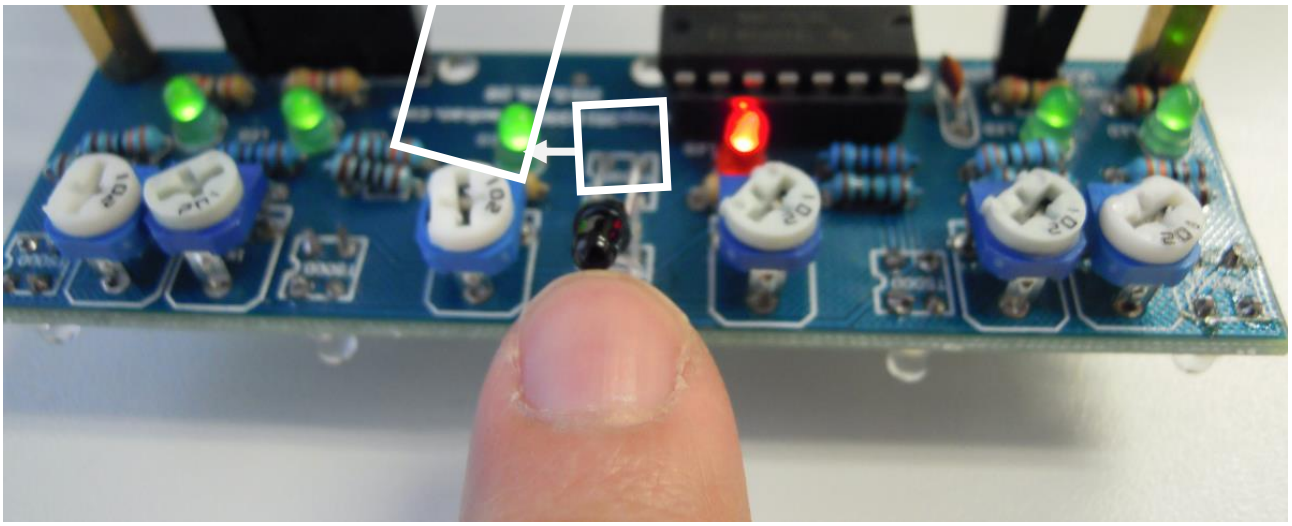


(a) Put the sensors under a white sheet like the following figure. Tune the floor sensor using cross screw until all lights are just lighted up.

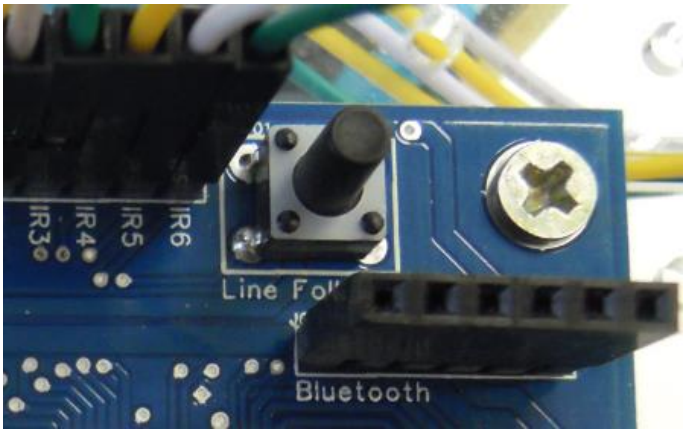
(b) Put the sensors on a black sheet and tune all sensors to light out.



(c) Tune the front sensor. The LED will be lighted up when it is blocked. Repeat step (a) and (b) for tuning

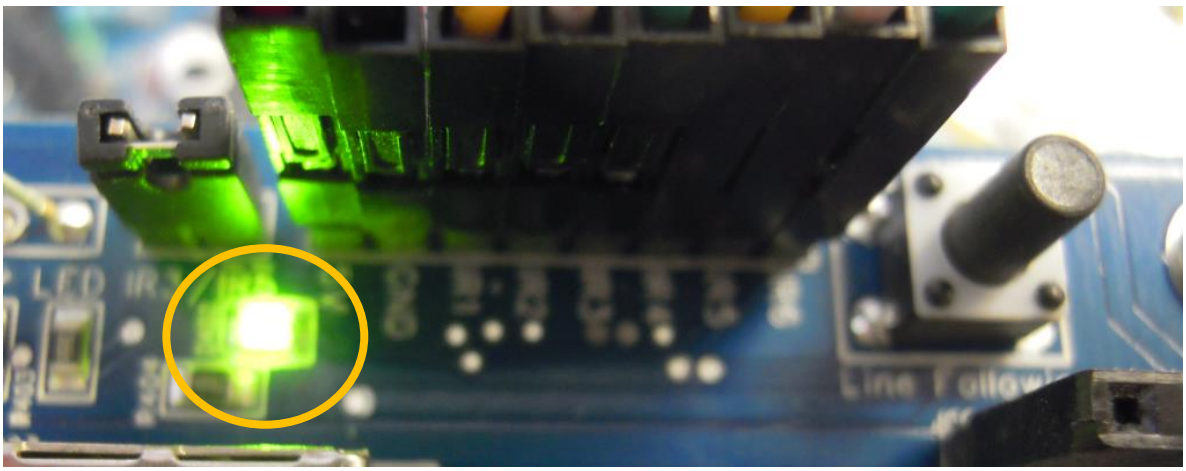


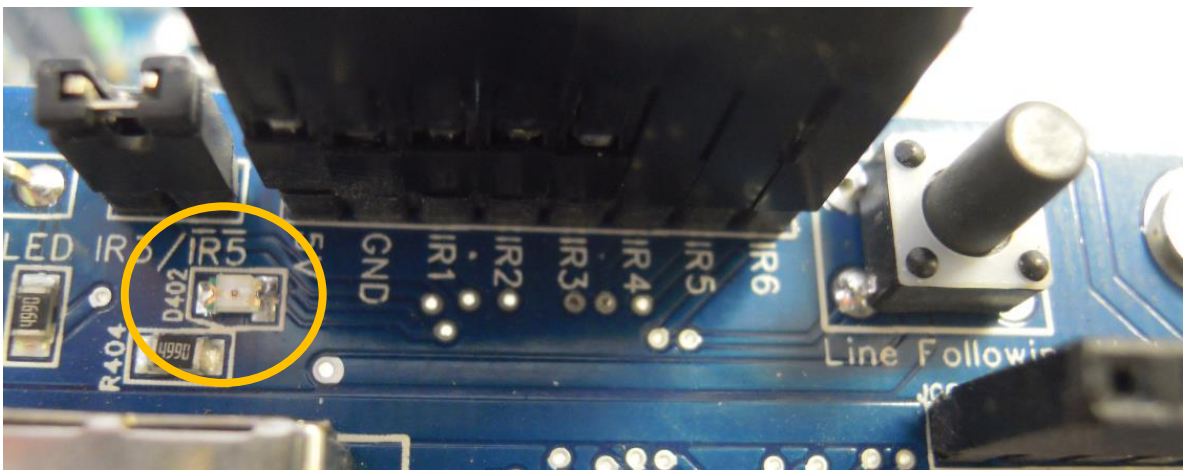
(d) the switch can adjust the on, off of Line Following Mode



(e) the LED will be off when entered Line Following Mode

*During Line Following Mode, it cannot be programmed until the switch is pressed again





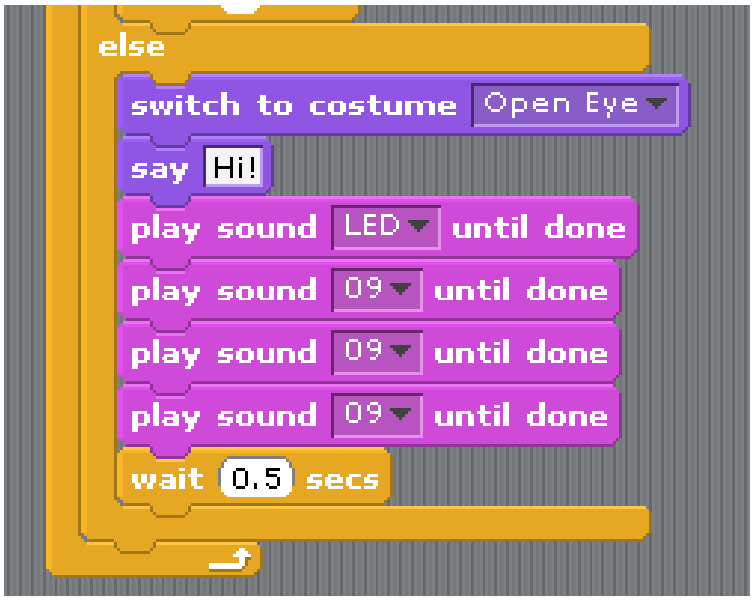
G. Scratch Reference

Scratch is a free programming tool developed by MIT. Its download link is:
http://info.scratch.mit.edu/Scratch_1.4_Download

"MIDbot™ iBuddy" supports various programming language. To facilitate learning and teaching, tutorial material for Scratch (containing comments and explanations) is attached to the kit. Please read carefully.

Basic usage
Scratch interface
Specified sound is used for control signal

Use “play sound … until done” for sending the signal.



Appendix I：Command Set

Basic Command	Description
LED	LED Control Command
Fan Speed	Controls Fan Speed
Speed	Controls Moving Speed
Forward	Moves Forward
Backward	Moves Backward
Left	Moves Left
Right	Moves Right
Stop	Stops Moving
Reset	Resets all
Fan Stop	Stops the Fan
Fan anticlockwise	Fan turns anticlockwise
Fan clockwise	Fan turns clockwise
(0)~(9)	Command Set number

Below are all command sets：

A. LED Command Set	Description
LED + (0)~(9) + (0)~(9) + (0)~(9)	First, select “LED”. Then, enter the value for red, green and blue. 0 is the darkest and 9 is the brightest. Eg: White Light: LED+(9)+(9)+(9); Blue light：LED+(0)+(0)+(9)
B. Robot Control	**Description**
Moving: Forward/backward/left/right/stop	Enter once
Moving Speed: Speed+ (1)~(9)	First select “Speed”. Then choose (1)~(9). E.g.: Speed 3: Speed + (3)
C. Fan Command Set	**Description**
Fan Stop/Fan anticlockwise/Fan clockwise	Enter Once
Fan Speed +(1)~(9)	First select “Fan Speed”. Then choose (1)~(9). E.g.: Fan Speed 6: Fan Speed + (6)

Appendix II：LED Code Table

LED Code	Color
000	
900	
990	
090	
099	
009	
909	
999	

***There can be 1000 types of color**

Appendix III：FAQ

Programming

Q: Is iBuddy controllable with Scratch?

A: iBuddy can be controlled by Scratch. However, as iBuddy requires dedicated sound file to control, please use the scratch file we provided.

Q: Is iBuddy controllable when signal cable is connected?

A: iBuddy uses audio for controlling. Please tune the sound volume to maximum.

Bluetooth control

Q: Can I remote control iBuddy if my desktop computer does not have built-in Bluetooth?

A: Please buy an external Bluetooth dongle (e.g. USB).

Q: How to pair up Bluetooth?

A: Please refer to other document.

Q: Can I use Bluetooth control in classroom?

A: Bluetooth support one-to-one pairing which is not easily jammed or interfered.